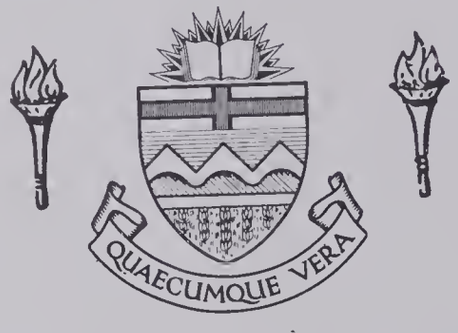

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A SERIAL WORD ASSOCIATION TEST OF SCHIZOPHRENIC THINKING

by

© A. BRUCE S. WALKER

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled A Serial Word Association Test of Schizophrenic Thinking submitted by A. Bruce S. Walker in partial fulfilment of the requirements for the degree of Master of Arts.

ABSTRACT

This study attempted to provide empirical evidence of Bleuler's (1950) "loosening of associations" phenomenon in schizophrenia through the use of a serial word association test. Since this test represents a new approach to the study of word associations, a secondary aim of this research project was to explore the feasibility of the test as a clinical instrument.

In the administration of the serial word association test, a stimulus word written on a small card was exposed to each S for 2 seconds and then removed. According to instructions given beforehand, the S wrote on each of 10 cards provided serially, the first word that came to his mind. He wrote one word on each card presented, giving a total of 10 response words to each stimulus word. Each response card was removed immediately upon completion and before a new, blank card was presented, in order to reduce ongoing stimulation. This procedure was repeated for a total of 10 stimulus words. All response words were then classified using criteria which specified various types of stimulus-response relatedness. Those response words which failed to adhere to the criteria were considered to be "unrelated" associations.

Three hypotheses were offered:

1. (a) Schizophrenic patients, in comparison to control patients, would give a significantly

greater number of "unrelated" associative responses;

(b) The condition hypothesized in (a) would hold true especially in the latter serial associations given to a stimulus word;

2. Normal control patients would exhibit a relatively constant number of "unrelated" responses over the ten serial associations following a stimulus word.

The experimental group consisted of 20 male, non-paranoid schizophrenics from the Alberta Hospital, Edmonton. The control group was composed of 20 male patients from Glenrose Hospital, each of which was receiving medical rehabilitation for injuries sustained in various types of accidents. Both groups were closely matched with regard to age and intelligence; however, other variables, including length of hospitalization and medication could not be controlled.

Test results are reported using the means and standard deviations of each group for all types of associations on each serial trial. Between-group differences were analyzed with the "t-test" and "F-ratio."

Hypothesis 1 (a) and 1 (b) were supported by the test results. These results were interpreted as an empirical demonstration of the "loosening of associations" in schizophrenia. Hypothesis 2 failed to receive support. In addition, relatively consistent between-group differences

were observed on some types of "related" associations. It was concluded that, with further refinement, the serial word association test could become a useful clinical instrument.

ACKNOWLEDGMENTS

Many people have assisted in the preparation of this thesis. I am particularly grateful to Dr. D. Spearman, of the Department of Psychology, both for his advice and encouragement throughout this project, and for the valuable experience of being a student under his supervision. I am also indebted to Dr. C. Larsen and Dr. D. Schaeffer for their constructive comments and criticizm of this project.

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CHAPTER I

INTRODUCTION

In a survey of schizophrenic incidence and prevalence figures from around the world, Dunham (1965) places the true incidence of the disease at approximately one per two thousand population and the prevalence at somewhere between two and eighteen per two thousand population. These incidence figures are based upon the number of first admissions to hospital within a given period of time, while the prevalence figures are based on surveys carried out within the community. If these figures approximate the true extent of this malady, then the total number of persons afflicted becomes staggering, and the need to understand it, pressing.

While many symptoms are attributed to schizophrenia, including disturbances of affect, disturbances of association, autism, ambivalence, hallucinations, and delusions, this thesis will focus on the associative processes only, and will attempt to increase understanding of these processes through the use of a serial word association test.

Survey of the Literature

It is beyond the scope of this thesis to attempt a comprehensive survey of schizophrenia. Therefore, inclusion of literature will be restricted to that which makes specific

reference to the importance of the associative processes in schizophrenia.

In a like manner, the literature on word association is voluminous and, for the most part, not essential to the development of this thesis. Inclusion of material in this area will be restricted to that which compares the type of response word given by schizophrenics with that of normal controls.

One of the earliest and probably still the most extensive treatment of associations and schizophrenia is that of Bleuler (1950) who was the first to use the term "loosening of the associations" [p.352] in describing the disturbances of schizophrenia. Although maintaining that the cause of the disease must be sought in organic factors, Bleuler's (1951) focus on the associative processes is aptly illustrated in the following:

> The innumerable actual and latent ideas which determine associations in normal trains of ideas may be rendered, singly or in any combination, ineffective in schizophrenia. In turn, ideas may come into play that have little or no connection to the main idea, and should have been excluded from the train of thought. Thereby thinking is rendered incoherent, bizarre, incorrect, and abrupt. At times all threads fail, and the train of thought is arrested; after such blocking, ideas lacking any recognizable connection to previous

ones may emerge [p.596-597].

Implicit in this description is the intrusion of apparently extraneous material into the "train of thought."

Disturbances in the associative processes were considered by Bleuler (1950, 1951) as a basic or primary symptom of schizophrenia. Most other symptoms, including hallucinations, delusions, catatonic postures, autism, and pathological ambivalence are considered secondary symptoms and "are a direct consequence of the loosening of the associations.....[1950, p.352]." It is the loosening of associations that allows the "splitting" of the personality into different idea complexes, anyone of which can assume a position of dominance over the others at a particular time. In addition, the loosening of associations "can lead to an irregular fragmentation of such solidly established elements as concrete ideas [1950, p.362]."

Finally, while Bleuler (1950) views the propensity towards looseness of association as primary in schizophrenia, "the choice of associations which are actually disturbed, is secondarily determined by the affectively charged complexes [p.352]." In recognizing the effect of complexes on the associative process, Bleuler approaches the position taken by Jung (1936).

Jung's (1936) views on dementia praecox as they relate to associative behavior in schizophrenia are based upon his ideas of "emotional complexes [p.33]." These

complexes embrace the sensations, intellectual components, and emotions of previous experiences and are an essential factor in all personalities. In persons with dementia praecox however, these complexes become dominant, completely inundating the ego structure such that "the subject can no longer free himself psychologically from a certain complex; he continually associates this complex and allows all his actions to be constellated by it [p.62]." In a more direct reference on the effect of a complex in a word association task, Jung (1936) indicates that a complex "suspends for a short time the effect of the directing idea (attention to the stimulus word) or simply diminishes it [p.47]." Jung (1910, 1936) has used both single word and serial association tasks in his studies.

In a thorough analysis and discussion of the word association test, Rapaport, Gill and Schafer (1946) divide the associative process into two phases - the analytic and the synthetic phase. The analytic phase consists of a working through the "components of the stimulus idea [p.24]", and a disturbance of the associative process in this phase produces "close reactions [p.24]", among which are included: repetition of the stimulus word, multi-word definitions, self references, distortion or amendment of the stimulus word, and clang associations. The synthetic phase of word association occurs when the associative process leaves the "components of the stimulus word" and passes on to other

ideas. Disturbances here lead to "distant reactions [p.28]" which include responses of little or no apparent connection with the stimulus word, vague responses, idiosyncratic responses, and generalizing responses. Associative disturbances in either the analytic or synthetic phase are considered by Rapaport (1946) as being characteristic of schizophrenia, especially if prevalent in a test performance.

In a discussion of associative disturbances in schizophrenia, Arieti (1955) describes four characteristics, given here in increasing order of severity of illness:

1. Schizophrenic thoughts are connected only by the simple laws of association (similarity or contiguity). There is no overall logical direction to them.
2. Schizophrenic thoughts are connected by phonetic similarity.
3. Schizophrenic thoughts show a decreased use of association by similarity because of a tendency for a schizophrenic to identify, rather than abstract.
4. "Not only ideas which might associate by similarity but also ideas which associate by contiguity are no longer just associated, but paleologically identified. One idea may be substituted for another,.....[p.260]."

Several of those characteristics, notably the lack of logical direction and the phonetic similarity are similar

to those expressed by both Bleuler (1950) and Jung (1936).

The primary focus of research dealing with schizophrenic-normal differences in word associations has been with reference to normative data, where schizophrenics, on single word, free associative tasks, have consistently given more unusual responses than have normal controls. Thus, Kent & Rosanoff (1910) found that "insane patients" gave more "individual" responses, and Lehman & Dorken (1953), Sommer, Dewar & Osmond (1960), Johnson, Weiss & Zelhart (1964), Wynn (1964), and Moran (1964) all found that schizophrenics gave fewer "primary" responses than normal controls. In addition, Storms & Broen (1964), Dokecki, Polidaro & Cromwell (1965), and Shakow & Jellenek (1965) demonstrated less "response commonality" in the associations of schizophrenics. The individuality of the schizophrenic response to a word association task would seem to be a well established research finding.

There appears to have been little work done in relating the response word to the stimulus word with schizophrenics and normal controls. One of the earlier endeavors in this area is that of Murphy (1923) who devised a number of response categories, each one expressing some type of relatedness to the stimulus word. There were thirteen types of responses in all, including contiguity, similarity, co-ordinates, contrasts, supraordinates, adjective-noun responses, and verb responses. In a

comparison with normal subjects, Murphy found that schizophrenics gave more co-ordinate responses and fewer adjective-noun responses.

Tendler (1945) extended the application of Murphy's (1923) categories to neurotics in addition to psychotics and normal control subjects. The results here indicated that while "contrast" responses were characteristic of normal control subjects, "adjective-noun" responses and "individual" responses were characteristic of neurotics and psychotics respectively. The psychotic group consisted of both schizophrenics and manic-depressives.

In an analysis of the responses given to a single word, free association test, Rapaport, Gill and Schafer (1946) compared the associations of schizophrenics, depressives, neurotics, and control subjects on a number of "qualitative" response dimensions. Among the response categories which differentiated schizophrenics from controls were repetitions, clang associations, and phrase completion associations, all of which were significantly more prevalent in the responses of schizophrenics. Of special relevance to this thesis, because of the similarity between these response categories and those of the present study, are the "distant reactions", where the response word is "related to the stimulus word in a far-fetched manner..... [p.41]", and the "unrelated reactions", where "no connection can be established between the stimulus - and reaction -

words.....[p.41]." The percentage of schizophrenic responses in each of these categories was significantly greater than that of the normal controls.

Flavell (1958) classified the responses of schizophrenics and normals on a single word, free association test into sixteen qualitative categories. The majority of these response categories did not differentiate between the two groups of Ss; among those which did were perseveration, clang, subordinate and distant responses. A "distant" response was defined as:

> ....unrelated or distantly related in meaning to the stimulus word, or else is a decidedly idiosyncratic, personal association which may possess a moderate semantic relationship to the stimulus word [p.3].

Using Flavell's (1958) categories, Milgram (1961) found that schizophrenics gave more "supraordinate" responses and fewer "verb" responses than did normal control subjects.

Association responses were classified as distant or misheard by Moon (1968), using a matched group of schizophrenics and normal control subjects. When the number of misheard responses was subtracted from the number of distant responses, the previously significant differences between the two groups was seen to disappear. It was concluded that "perceptual dysfunction" was responsible for the majority of the so called "distant" responses.

Statement of the Problem

As can be seen from the survey of the literature, little work has been done with the qualitative aspect of the response word. The stimulus-response relationship in a word association test has not been fully explored in terms of its possible ramifications for study and diagnosis of schizophrenic associative disturbances.

Further, the studies comparing schizophrenic and normal associations have used, almost exclusively, the single word association procedure. This procedure, while definitely having merit as Sommer et al (1960) point out, does nevertheless, leave much to be desired in attempting to study the "train of thought". The single word association task does not appear to tap the ongoing flow of associations which was considered by both Bleuler (1950) and Jung (1936) to be of major importance to the understanding of schizophrenia.

Appelbaum (1960) expressed the view that the chief determinant of the first associative response to a stimulus word is the frequency with which the associated word is paired with the stimulus word in everyday language. He maintains further, that an additional associative response to the same stimulus word will increase the probability of obtaining an "idiosyncratic, self revealing [p.259]" response. Subsequent work by Osipow and Grooms (1965) supports Appelbaum's (1960) observations by maintaining that chains of verbal responses might be more useful than single

word responses in clinical diagnosis, as additional responses become less stimulus bound.

Recently, Baldridge (1968) used an "iterative association" procedure which, in essence, required the S to associate to his own, previously given associations. The first association to a stimulus word was noted and given later as a stimulus word, and the response given to this second stimulus word was also noted and presented later in the task as a stimulus word. In this manner, ten response words were obtained to each of fifteen original stimulus words. The responses of a paranoid schizophrenic are reproduced in Appendix A and are considered illustrative of the "richness of information that can be obtained [p.127]", using this technique. Overall, the results of this study show a tendency to "converge on areas of concern [p.127]" for all three groups of subjects - male college students, medical patients, and schizophrenics - however, no pronounced differences in associations were apparent between the groups.

The serial word association test used in the present study represents a relatively new approach to the study of schizophrenic associative processes. It is designed to elicit a series of words in the absence of external stimulation. These words are then classified according to their relatedness to a previously presented stimulus word.

The Hypotheses

It was hypothesized that;

1. (a) Schizophrenic patients, in comparison to control patients, would give a significantly greater number of "unrelated" associative responses;

   (b) The condition hypothesized in (a) would hold true especially in the latter serial associations given to a stimulus word;

2. Normal control patients would exhibit a relatively constant number of "unrelated" responses over the ten serial associations following a stimulus word.

CHAPTER II

PROCEDURE

Selection and Description of Sample

The experimental group consisted of 20 male patients from the Alberta Hospital, Edmonton, an 1100 bed mental hospital located near the city. All were schizophrenics, either simple or catatonic according to psychiatric diagnosis. Patients who exhibited any paranoid symptoms or tendencies were not used in this study. The control group was composed of 20 male patients from the Glenrose Hospital, a 300 bed general and rehabilitation hospital located within Edmonton proper. All patients used in the control group were accident victims suffering from leg, hip, back, or arm injuries requiring rehabilitation care in a hospital setting.

In selecting the experimental group, the names and ward numbers of all male patients of suitable age and diagnosis were obtained from the hospital master file. Examination of the ward numbers revealed that a preponderance of these patients were located on two wards. The patients finally selected for testing came from these wards. The names of appropriate control patients were obtained in a similar manner. The majority of these patients were located in one ward.

Participation in this study was voluntary for patients in both the experimental and control group. Consent was refused by one experimental and one control patient. Arrangements for testing were made by the writer on an individual basis with each of the control patients, on a day prior to the actual testing. At this first meeting, an explanation of the nature and purpose of this study was given, consent was obtained, and a mutually agreeable time was set for testing. Time arrangements were made beforehand to avoid conflict with the patient's regular treatment program. Patients in the experimental group were obtained in a similar manner, the only difference being that these patients were tested immediately after consent was obtained as hospital routine did not necessitate a pre-arranged time for testing.

The two groups of patients were matched on the basis of age. As can be seen from Table I, the patients in each group are closely comparable with regard to age.

TABLE I

AGE RANGE, MEANS, AND STANDARD DEVIATIONS OF EXPERIMENTAL AND CONTROL PATIENTS

Classification	N	Age Range	Means	Standard Deviations
Experimental Group	20	23 - 44	32.5	6.6
Control Group	20	24 - 42	32.4	5.9
F = 1.25		df = 19 & 19		N.S.
t = .08 (two-tailed test)		df = 38	N.S.	

The "t-test" formula used throughout this thesis is from Edwards (1963), and is given in Appendix B. The F-ratio formula is from this same source and is given in Appendix C.

In an attempt to control for the variable of intelligence or verbal ability between the groups, a split-half version of the Vocabulary subtest of the Wechsler Adult Intelligence Scale (hereafter referred to as the WAIS) was administered individually to each patient upon completion of the serial word association test. This version of the Vocabulary subtest involves the administration of every second word in the subtest, and was used in preference to the full administration so as to reduce the total testing

time required of each patient. This procedure has yielded results very similar to those obtained with the full administration of the subtest (Satz & Mogel, 1962). Standard administration and scoring procedures (Wechsler, 1955) were followed in every other respect. It will be noted in Table II that there is significantly greater variability in the scores obtained by experimental patients compared to those of the control patients. In order to ascertain the possible effect of this variability on serial word association performance, four Pearson product moment correlation coefficients were calculated between WAIS vocabulary scores and "unrelated" associations. These correlation coefficients, varying in value from -.13 to .25 were all insignificant, a finding which, in the writer's opinion, greatly diminishes the possibility of intelligence variability effecting serial word association performance. In addition, analyses of covariance between WAIS scores and "irrelevant" associations on both trial 9 and 10 produced significant group differences ($F = 6.78$, $p<.05$) similar to that obtained with a "t-test", thus indicating that variability of intelligence has little effect on the "irrelevant" serial associations. On the basis of the group mean scores shown in Table II, it is concluded that the variable of intelligence is controlled.

TABLE II

WAIS VOCABULARY SCALED SCORES: RANGE, MEANS, AND STANDARD DEVIATIONS OF THE EXPERIMENTAL AND CONTROL GROUP

Classification	N	Scaled Score Range	Means	Standard Deviations
Experimental Group	20	4 - 17	9.3	3.1
Control Group	20	7 - 13	9.5	1.5
F = 4.23		df = 19 & 19		p<.01
t = .25 (two-tailed test)		df = 19	N.S.	

Owing to the difficulty of obtaining a representative control group, the length of hospitalization could not be controlled. The statistically significant differences between the two groups in this respect, can readily be seen in Table III.

TABLE III

LENGTH OF HOSPITALIZATION IN DAYS: RANGE, MEANS, AND STANDARD DEVIATIONS OF THE EXPERIMENTAL AND CONTROL GROUPS

Classification	N	Hospitalization Range	Means	Standard Deviations
Experimental Group	20	6 - 182	79.6	58
Control Group	20	9 - 138	40.9	36
F = 2.58		df = 19 & 19		p<.05
t = 3.81 (two-tailed test)		df = 19	p<.01	

One of the greatest limitations in research of this nature is the failure to obtain a representative control group. Ideally, the control and experimental group should be matched on all variables except the one under study. While the variables of age, sex, and verbal intelligence have been controlled in the present study, as is shown in Table I and II, length of hospitalization is an uncontrolled variable as can be seen in Table III. In addition, other variables of possible importance such as socio-economic status, marital status, and amount of schooling are also uncontrolled in this study. The effect of these variables

on the serial word association test performance is largely unknown. It should also be noted that there was no attempt in this study to control for effects of medication. The results of the present study should be interpreted in light of these inadequacies of control.

Description of the Serial Word Association Test

The serial word association test (hereafter referred to as the serial WAT) is a new technique, and it will therefore be described in some detail for purposes of clarification.

Patients sat at a table facing the examiner and were tested individually using the serial WAT. The patients in the experimental group were tested in private rooms, either on or off the ward. The majority of the patients in the control group were also tested in privacy, in a room just off the ward. A few, however, were confined to their beds and were therefore tested in their own room. When this situation arose with patients in a semi-private or public room, other patients were asked by the nursing staff to leave temporarily. As a result, a high degree of privacy was obtained in testing all patients.

The ten stimulus words used in this serial WAT are listed below, in the order of their presentation. They are:

1. horse
2. car
3. table
4. hat
5. hammer
6. green
7. sparrow
8. hand
9. butterfly
10. spoon

On the basis of preliminary work, these words were selected as being neutral, common, and capable of eliciting a variety of classifiable response words from both schizophrenic and normal control subjects.

The stimulus words were printed on plain, white, 1 2/3" X 3" cards, one word to a card. A black felt pen was used in printing. The stimulus cards used in the testing of all patients are reproduced in Appendix D. The cards upon which the patient wrote each of his associative response words were identical to the stimulus cards, except they were blank. A ball point pen was provided for writing.

At the beginning of the testing procedure, the instructions given to each patient were as follows:

> I am going to show you a word printed on a small card. I want you to look at the word and think about the word for a short time. I will then take the word away and give you a blank card, on which you are to write the first word that you think of - the first word that comes to mind. After you've written a word, I'll take that card away too and give you another card, so you can write down the next word you think of - and so on. I would like you to continue writing words that come to mind as I continue giving you cards. After I tell you to stop, I'll show you another word printed on a card and we'll do the same thing again. Are there any questions?

Questions were answered by repeating, as closely as possible, the relevant part of the initial instructions.

The first stimulus card was exposed to the patient for 3 seconds and then removed from the table. As this card was removed, a blank response card was presented, whereupon the patient, according to instructions given beforehand, was to write the first word that came to mind. Immediately upon completion, this card was removed from the patient, turned over to prevent ongoing stimulation, and a second blank response card was presented. This too was removed upon completion, and a third blank card presented. The same procedure was followed until 10 associative response words had been obtained, one on each of the 10 response cards that were given serially to the patient following the presentation of the first stimulus word. The second stimulus word was then presented in the same manner as was the first, and the same procedure was followed until 10 response words had also been obtained following the presentation of this stimulus word. The 8 remaining stimulus words with their subsequent response words were treated in a like manner. Upon completion of testing, then, the patient had written 100 response words, 10 serial responses following the presentation of each of the 10 stimulus words. The time taken by the patient to begin writing each word on the blank card was recorded by the examiner as the patient wrote. No stimulus word nor previously written response word was visible to the patient as he was writing, or preparing to write a response word.

When testing was completed, each response word written by the patient was examined by the writer in the presence of the patient. This was done to insure that each word was legible and to clarify the meaning intended by the patient in those words with dual meanings.

As described above, the serial WAT represents a departure in technique from the single WAT by requiring the subject to give a number of associations following the presentation of the stimulus word. Also, it differs from the continued WAT used by Noble (1952), Cofer & Shevitz (1952), and Koen (1962), in that the stimulus word is not visible to the subject following its initial presentation. In contrast to the iterative WAT of Baldridge (1969) and the discrete serial WAT of Fosmire (1965), the serial WAT used in the present study elicits a series of associations, uninterupted by the presentation of other stimulus words. The elicitation of an uninterupted series of associations in the absence of external, ongoing stimulation is seen by the writer as being more representative of the "train of thought" (Bleuler, 1951, p.596) than are the other word association methods. As such, the serial WAT is the most appropriate method for the study of possible "loosening of associations" (Bleuler, 1951, p.596) in schizophrenia.

Analysis of the Serial Word Associations

To facilitate the categorization of response words, all of these words were transferred from their individual cards to master sheets. An assistant[1] was used in this process in order to prevent this writer from becoming overly familiar with the responses prior to categorizing them. A random number was assigned to each sheet and the name of the patient removed from it. Thus, each patient's response words were available, in the order elicited, on a master sheet, and were classified by the writer without knowledge of the group to which the responses belonged. While not absolutely necessary, this procedure of "blind analysis" was thought desirable in order to eliminate possible bias in the classification of some responses.

The categories used in the classification of the serial associative response words all have as a referent, the stimulus word which they followed. There were 5 primary categories used, each of which represents a different type of relatedness between the stimulus word and the subsequent serial association words. These categories were developed by the writer in pilot work.

The categories that were applied to each serial association are listed below, along with a description of the criteria necessary for the inclusion of an association

---

[1] Male graduate student with a B.A. degree in Psychology

in a category. Also given, for illustrative purposes, are examples of classifiable association words which occurred subsequent to the presentation of the first stimulus word, "horse". It should be noted that an association word was not classified under more than one category, and many words were not classifiable under any category. These unclassifiable words will be discussed later in this paper. The associative categories are:

1. Analytic Associations: those words which represent a breaking down of the stimulus word object into its parts or components (eg. HORSE - tail, hoof, hair).
2. Descriptive Associations: those words which describe the stimulus word object by drawing attention to its attributes or characteristics, including those words which serve to differentiate types of the stimulus word object (eg. HORSE - brown, fast, pinto).
3. Action Associations: those words which represent activities usually and realistically ascribed to the stimulus word object including; (1) action which the stimulus object is capable of performing (eg. HORSE - gallop, jump); (2) action directed toward the stimulus object (eg. HORSE - ride, curry); and (3) action associated with the stimulus object (eg. HORSE - show, stampede).

4. In-Category Associations; those words which can be included under a category specified beforehand by the writer for each stimulus object. The stimulus words, along with their specified categories are listed in Table IV.

TABLE IV

SPECIFIED CATEGORIES OF THE IN-CATEGORY ASSOCIATIONS FOR EACH STIMULUS WORD

Stimulus Word	Specified Category
horse	animal
car	vehicle
table	furniture
hat	wearing apparel
hammer	tool
green	color
sparrow	bird
hand	human body part
butterfly	insect
spoon	eating utensil

Examples of the serial associations given subsequent to the stimulus word HORSE, and classifiable as In-Category Associations are cow, donkey, and mouse.

5. Physical Proximity Associations: those words which represent objects usually or realistically found in relatively close physical proximity to the stimulus object (eg. HORSE - saddle, wagon, barn).

A more extensive presentation involving some of the serial word associations that were classifiable under each associative category is given in Appendices E through I. These words were obtained from the protocols of both experimental and control patients and are listed to illustrate the application of the associative categories outlined above.

Through the use of these categories, 69% of serial word associations given by control patients and 49% of the associations given by experimental patients were classified. Because each of the categories represents a different type of relatedness between the stimulus word and the serial associate, all of these words are considered to be related to the stimulus word which they follow. The majority of the remaining serial associations, including 30% of those given by control patients and 48% of those given by experimental patients were not classifiable under these categories and are therefore considered to be unrelated associations. Examples of some of the unrelated associations and the stimulus words which they followed are given in Appendix J. These words were also taken from the protocols of both experimental and control patients.

A small percentage of the serial associations given by both experimental and control patients were repetitions of either the stimulus word or a previously given related association. These repetitions comprise 3% of the associations given by experimental patients and 1% of those given by control patients. They cannot be classified as either related or unrelated associates and will not be discussed further.

As one of the implicit aims of this research was to explore the feasibility of the serial WAT as a diagnostic tool, the writer thought it necessary to demonstrate the applicability of the criteria used in the classification of the serial associations. In pursuing this end, two persons with B.A. degrees in psychology were involved in the research. They were given a brief explanation and outline of the criteria and categories used in the classification of the serial associations, and each person then classified 320 of the responses given by a random sample of four experimental and four control patients. Each person classified all of the responses given to four randomly selected stimulus words by each of the eight patients in their respective sample. The classifications of each scorer were then compared with those done previously by the writer. On initial comparison, there was agreement between the writer and each scorer on 88% and 95% respectively of the words classified. Subsequent discussion of the classification of each word resolved some of the differences,

leaving 90% and 99% agreement respectively between each scorer and the writer. This percentage of agreement is thought to be high enough to justify the use of these categories and their criteria in the event that the serial WAT proves valuable as a diagnostic tool. It compares favorably with the 80% inter-judge agreement obtained by Flavell (1958).

CHAPTER III

TEST RESULTS

The results of the serial word association test, classified according to the criteria outlined in the last chapter, are presented in Tables V through XII. All tables give the means and standard deviations of each patient group with regard to a particular category of associative words. The "Trials" from 1 to 10, refer to the serial order of the response associations given subsequent to the presentation of the stimulus word. Thus, Trial 1 refers to the first word subsequent to the stimulus word, Trial 2, the second word following the stimulus word, and so on. Where warranted by inspection of the data, statistical significance tests of group differences were calculated.

The overall mean scores and standard deviations of the experimental and control group on "unrelated" serial associations are shown in Table V. As can be seen, the experimental group gave significantly more "unrelated" associations.

TABLE V

UNRELATED SERIAL ASSOCIATIONS: OVERALL MEAN SCORES AND STANDARD DEVIATIONS FOR EXPERIMENTAL AND CONTROL GROUPS

Classification	N	Means	Standard Deviations
Experimental Group	20	46.25	28.50
Control Group	20	29.85	17.20
F = 2.75		df=19&19	p<.05
t^1 = 2.20	df=19	p<.05	

[1]One-tailed test

An analysis of the "unrelated" associations on each trial for both patient groups is shown in Table VI. These figures represent the associations given over all stimulus words. Of note here is the fact that 7 of the 10 mean differences are statistically significant with 5 of these significant differences occurring in the last 5 serial association trials. The increasing discrepancy of performance between the experimental and control group over trials is shown more clearly in Appendix K, where the mean scores of each group are presented graphically.

TABLE VI

UNRELATED SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
1	1.55	2.31	.65	.81	p<.01	* N.S.
2	3.75	3.09	2.30	1.59	p<.01	*p<.05
3	4.15	3.12	2.20	1.77	p<.01	*p<.05
4	3.95	3.07	3.30	2.28	N.S.	** N.S.
5	4.90	3.24	3.40	2.60	N.S.	** N.S.
6	4.95	3.32	3.25	2.14	p<.05	*p<.05
7	5.35	3.18	3.40	2.42	N.S.	**p<.05
8	5.55	3.47	3.75	2.20	p<.05	*p<.05
9	5.90	3.34	3.95	2.26	N.S.	**p<.05
10	6.10	3.20	3.75	2.50	N.S.	**p<.01

[1] One-tailed test

Table VII shows the "unrelated" serial associate mean scores and standard deviations of the patient groups for each stimulus word. Group mean differences were significant at the .05 level for associations following 5 of the 10 stimulus words. In 4 of the remaining mean differences, a significance level of .10 or less was obtained. The relatively consistent mean differences between groups for "unrelated" associations following 9 of the 10 stimulus words are shown more clearly in the graph of Appendix L.

Each of the remaining tables, from Table VIII through XII, contains the analysis of one type of "related" association over the 10 trials. As can be seen in these tables, few significant differences between experimental and control groups were obtained for "analytic", "descriptive", or "in-category" serial associations. However, the experimental group, by comparison with the control group, gave significantly fewer "action" associations on 9 of the 10 association trials, and significantly fewer "physical proximity" associations on 5 of the 10 trials.

TABLE VII

UNRELATED SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OF EXPERIMENTAL AND CONTROL GROUP OVER ALL TRIALS FOR EACH STIMULUS WORD

Stimulus Words	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
horse	5.50	3.10	2.85	2.58	N.S.	**p<.01
car	4.95	3.85	3.15	2.92	N.S.	**p<.05
table	4.45	3.55	3.10	2.36	p<.05	* N.S.
hat	4.75	3.59	5.00	2.77	N.S.	** N.S.
hammer	4.60	3.49	3.25	2.47	N.S.	** N.S.
green	3.65	3.50	1.65	2.25	p<.05	*p<.05
sparrow	4.40	3.07	2.15	1.60	p<.01	*p<.01
hand	4.45	3.88	2.10	2.28	p<.05	*p<.05
butterfly	5.25	3.07	3.90	1.48	p<.01	* N.S.
spoon	4.15	3.59	2.60	2.50	N.S.	** N.S.

[1] One-tailed test

TABLE VIII

ANALYTIC SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group	
	Means	Standard Deviations	Means	Standard Deviations
1	1.00	1.08	.50	.94
2	.95	1.08	.85	.99
3	.70	.87	.55	.68
4	.70	1.03	.70	.87
5	.50	.76	.70	.87
6	.60	.76	.65	.88
7	.50	.69	.70	.93
8	.35	.49	.35	.49
9	.40	.60	.70	.87
10	.50	.69	.75	1.12

TABLE IX

DESCRIPTIVE SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
1	.65	.99	1.90	1.55	p<.05	*p<.01
2	.95	1.58	1.70	1.42	N.S.	** N.S.
3	1.05	1.28	1.10	1.46	N.S.	** N.S.
4	1.25	1.33	1.85	1.81	N.S.	** N.S.
5	1.05	1.10	1.55	1.91	p<.01	* N.S.
6	1.45	1.73	1.85	1.75	N.S.	** N.S.
7	1.35	1.35	2.20	1.61	N.S.	** N.S.
8	1.10	1.25	1.65	2.19	p<.01	* N.S.
9	1.05	1.19	1.30	1.86	p<.05	* N.S.
10	1.10	1.41	1.75	1.74	N.S.	** N.S.

[1] Two-tailed test

TABLE X

ACTION SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
1	.30	.74	1.90	1.80	p<.01	*p<.01
2	.50	.82	1.65	1.46	p<.01	*p<.01
3	.35	.81	1.70	1.22	p<.05	*p<.01
4	.60	.94	1.35	1.23	N.S.	**p<.05
5	.50	.76	1.25	1.25	p<.05	*p<.05
6	.35	.58	1.60	1.73	p<.01	*p<.01
7	.25	.64	1.75	1.29	p<.01	*p<.01
8	.40	.88	1.35	.93	N.S.	**p<.01
9	.25	.45	1.55	1.10	p<.01	*p<.01
10	.40	.82	1.15	1.53	p<.01	* N.S.

[1] Two-tailed test

TABLE XI

IN-CATEGORY SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
1	3.50	2.39	3.15	2.03	N.S.	** N.S.
2	2.90	3.06	1.00	1.54	p<.01	* N.S.
3	2.30	2.90	1.70	1.90	p<.05	* N.S.
4	2.40	2.58	1.55	2.06	N.S.	** N.S.
5	1.90	2.52	1.65	1.66	p<.05	* N.S.
6	1.50	2.37	1.20	1.58	p<.05	* N.S.
7	1.60	1.96	.95	1.61	N.S.	** N.S.
8	1.55	2.04	1.20	1.71	N.S.	** N.S.
9	1.25	1.89	1.00	1.26	p<.05	* N.S.
10	1.15	1.93	.85	1.18	p<.05	* N.S.

[1]Two-tailed test

TABLE XII

PHYSICAL PROXIMITY SERIAL ASSOCIATIONS: MEANS AND STANDARD DEVIATIONS OVER ALL STIMULUS WORDS FOR EXPERIMENTAL AND CONTROL GROUPS

Trials	Experimental Group		Control Group		Variance F-ratio	t-test[1]
	Means	Standard Deviations	Means	Standard Deviations	df=19&19	*df=19 **df=38
1	1.05	1.50	1.70	1.34	N.S.	** N.S.
2	.80	1.15	1.80	1.22	N.S.	**p<.05
3	1.15	1.22	2.15	1.60	N.S.	**p<.05
4	.75	.96	1.25	1.02	N.S.	** N.S.
5	.65	.88	1.45	1.50	p<.05	* N.S.
6	.90	1.29	1.30	1.38	N.S.	** N.S.
7	.60	.82	1.45	1.23	p<.05	*p<.05
8	.65	1.09	1.60	1.43	N.S.	**p<.05
9	.65	1.18	1.30	1.34	N.S.	** N.S.
10	.50	.83	1.50	1.50	p<.01	*p<.01

[1] Two-tailed test

It will be recalled that the hypotheses of this thesis deal only with the "unrelated" associations. Therefore, the different types of "related" associations are of only indirect concern. With this in mind, however, there are some pronounced differences in the proportions of different types of "related" associations given by each patient group. These figures are presented in Table XIII where the experimental group, in comparison to the control group, shows a high percentage of "in-category" associations and a low percentage of "action" associations.

TABLE XIII

PERCENTAGE AND NUMBER OF EACH TYPE OF RELATED ASSOCIATION GIVEN BY THE EXPERIMENTAL AND CONTROL GROUP

Types of Related Associations	Experimental Group		Control Group	
	Percentage	Number	Percentage	Number
Analytic	13	124	10	132
Descriptive	23	220	24	327
Action	8	78	22	305
In-Category	41	401	22	297
Physical Proximity	16	154	23	310
TOTAL	101	977	101	1371

CHAPTER IV

DISCUSSION OF TEST RESULTS

The test results of this study are seen by the writer as supporting the implicit expectation of group differentiation on the basis of the serial word association test. It will be recalled that the hypotheses deal only with the "unrelated" associations; however, as relatively clear cut group differences were observed on some types of "related" associations, these too will be discussed.

Hypothesis I (a), which predicted the occurrence of a significantly greater number of "unrelated" associations in the overall performance of schizophrenic patients when compared to that of normal control patients, was supported by the results outlined in Table V. This finding is in keeping with the ideas expressed by Bleuler (1950) and Jung (1936), both of whom draw attention to the decreased relatedness between the association word and the observable stimulus in schizophrenic associative processes. This result is also seen as supporting Rapaport's (1946) finding of a greater number of "distant" and "unrelated" words in the associations of schizophrenics in comparison with non-schizophrenic patients and normal control subjects. It also supports Flavell's (1958) results of a greater number of "distant" responses in the performance of schizophrenics by comparison with normal control subjects.

The serial word association test was specifically designed to elicit a chain of associations following the presentation of a stimulus word, in a manner thought by this investigator to be more representative of the "train of thought" (Bleuler, 1951, p.597), than is the case with single word associations. Thus, Hypothesis I (b), by predicting an increased number of "unrelated" associations in the performance of schizophrenic patients during the latter trials, is the central hypothesis of this thesis. Support was obtained for this hypothesis as is indicated by the results reported in Table VI. These figures suggest that the schizophrenic associative processes tend to depart from the central or "directing idea" (Jung, 1936, p.47) as represented by the stimulus word. As a result of this increasing tendency to give "unrelated" associations during the latter responses to a stimulus word, the schizophrenic group can be increasingly differentiated from the normal control group during the latter trials. The 5 significant t-tests on the last 5 serial associative response trials attest to the increasing group differentiation which can readily be seen in the graph of Appendix K. To the extent that this series of associations can be taken as analogous to Bleuler's (1951) "train of thought", then the results outlined in Table VI can be interpreted as an empirical demonstration of the "loosening of associations" in schizophrenia.

Hypothesis 2, predicting a relatively constant number of "unrelated" serial associations for each trial in the normal control group, was based upon the assumption that the method of categorization would not be sufficiently sensitive to make apparent any trends in the normal associations, thus making the number of "unrelated" associations for this group a matter of random occurrence. This hypothesis was not supported by the test results, as can be seen in Table VI and Appendix K, where the number of "unrelated" associations given by the normal control group is seen to increase over the 10 association trials. The failure to support Hypothesis 2 is interpreted by this investigator as lending support to the validity of the system of categorization, as well as suggesting that the serial word association test has potential for the study of the associative processes in "normal" subjects.

Table VII shows the mean number of "unrelated" associations for each patient group on each stimulus word. The results here indicate the extent to which each stimulus word differentiates between the two patient groups in terms of the mean number of "unrelated" associations elicited subsequent to it. While only 5 of the 10 stimulus words discriminated between the patient groups at the .05 level of significance or less, it will be recalled that 4 of the remaining stimulus words discriminated at the .10 level or less. The only stimulus word which failed to elicit a

greater number of "unrelated" associations from the schizophrenic group was the word hat. One possible reason for the failure of this word to discriminate between groups may be in the inability of the system of categorization to identify associations which are related to this word. This would explain both the failure of this word to discriminate between groups and the fact that there were more "unrelated" associations given by normal control patients to this stimulus word than to any other stimulus word.

The analyses of the "related" serial associates produce some significant group mean differences as can be observed in Tables VIII through XII. The interpretation of these differences is difficult however, due to the fact that, by comparison with the normal control patients, the schizophrenic patients gave significantly fewer "related" responses in general, and therefore they would be expected to give fewer responses in any particular category of "related" associations. In an attempt to eliminate this shortcoming of the "related" association results, all types of "related" associations are listed in Table XIII as a percentage of the total number of "related" associations given by each patient group. Thus the total number of "related" responses is, in effect, held constant for each group and more meaningful between-group comparisons can be made.

The first type of "related" associations to show clear cut between-group differences is the "action" category of associations, where the schizophrenic group has a much lower percentage of associations in this category than does the normal control group. This finding is similar to that of Milgram (1961), in which schizophrenics gave a greater number of "verb" responses. The withdrawn and passive nature of the schizophrenic might lead to the prediction of fewer "action" associations from this group; however, an alternative explanation of these results could be found in the nature of the control group. Of possible relevance here are the findings of Wispé (1954) who used "normal" subjects under various types of deprivation conditions including food and water deprivation, and was able to identify in a word association task, a shift towards words related to the instrumental activities required to overcome this deprivation. Thus, since the patients of the control group were confined to a state of relative inactivity because of their injuries, the greater number of "action" associations given by them could be attributed to the activity deprivation. From the present study there is no way of ascertaining which explanation has the greater relevance for the observed group differences on "action" associations.

The second type of "related" association to differentiate the patient groups is the "in-category" association. Whereas 41% of the associations given by

schizophrenics were of this type, only 22% of those given by the normal control group could be similarly classified. The tendency of schizophrenics to give this type of response has been demonstrated in other studies as well, including that of Murphy (1923) and Milgram (1961) where schizophrenics gave more "coordinate" and "supraordinate" responses respectively, than did normal control subjects. The "coordinate" and "supraordinate" responses of these studies are seen by the writer as being similar to the "in-category" associations of the present study.

The "related" association test results of the present study show some agreement with those obtained by others dealing with the "qualitative" aspect of the responses to a word association test. This agreement is limited, however, as was concluded by Pavy (1968) after reviewing recent studies on word associations and schizophrenia.

> In summary, the work on associations in schizophrenia has shown that schizophrenic responses to association tasks are different from those of normals. However, no consistent pattern of response has been established for the schizophrenic population [p.166].

Contrary to expectations, the "unrelated" associations among schizophrenics showed no apparent indication of the presence of "affectively charged complexes" (Bleuler, 1950, p.352) or "emotional complexes" (Jung, 1936, p.33). This

result is in contrast to that obtained in pilot work where salient areas of fixation were seen in the "unrelated" associations. It should be noted however, that the present study was not designed to elucidate this aspect of schizophrenic thinking.

Concluding Remarks

The theoretical ideas of both Bleuler (1950) and Jung (1936) as they relate to disturbances of association in schizophrenia are borne out by the results of this thesis. Of special relevance here is the concept of "loosening of associations" (Bleuler, 1950) which was defined in this study in terms of "unrelated" associations, and subsequently supported by the test results.

Looseness of associations is an important symptom in the diagnosis of schizophrenia. Lehmann (1967) draws attention to the fact that there are few objective criteria which can be applied in this diagnosis, and then adds that "the loosening of associations - the specific thought disorder of the schizophrenic - is, perhaps, one of the most valuable diagnostic criteria [p.642]." Further support for this view is found in Schorer (1968) who studied cases which were diagnosed as schizophrenic upon admission to a treatment clinic and non-schizophrenic upon discharge. These cases were referred to as "pseudo-schizophrenics" and were considered to be examples of faulty admission diagnosis.

The author expresses the view that these faulty diagnoses result, almost exclusively, from a failure on the part of the physician, to pay adequate attention to thought processes in the diagnostic procedure. According to Schorer, the physician should not diagnose on the basis of behavior only, no matter how "outlandish" or "dramatic" this behavior may be; however, "If he can catch but one clear example of disrupted associations, he has a basis for the diagnosis of schizophrenia [p.122]." The serial word association test used in the present study shows some promise of being useful in diagnosing schizophrenia.

The results of the present study are seen by the writer as indicating the need for further research with serial associations and schizophrenia. One aspect of the results in need of clarification is the obtained group differentiation on "action" associations which, as was mentioned earlier, could be either a characteristic of schizophrenic thinking or a function of the type of patients used in the control group. In addition, subsequent work with this test might delete those stimulus words which failed to significantly differentiate between groups, thereby increasing the discriminatory power of the test. The increasing between group discrepancy on "unrelated" serial associations suggests the possibility of greater group differentiation with the use of a greater number of serial associations subsequent to the presentation of the stimulus word.

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APPENDIX A

ITERATIVE ASSOCIATION RESPONSES GIVEN BY A PARANOID SCHIZOPHRENIC

Source: Baldridge (1968)

1.	2.	3.	4.
animal	package	town	book
dog	Rwy. Express	city	history
cat	package	town	book
mouse	stamp	city	word
cat	letter	town	sentence
mouse	stamp	Cincinnati	words
animal	letter	city	sentence
plant	post office	town	words
animal	job	Munich	sentences
dog	unemployment	Hitler	oratory
cat	depression	Mussolini	Hitler

5.	6.	7.	8.
task	sound	dream	paper
job	ears	sleep	pen
unemployment	sound	dream	paper
post office	noise	nightmare	pen
civil service	television	dream	paper
government	people	sleep	pen
politics	parents	dream	paper
democratic	old age	sleep	pen
government	death	dream	author
Nazi's	resurrection	sleep	Mein Kampf
Hitler	grave	death	My Battle
	life		

9.	10.	11.	12.
house	bottle	plant	word
yard	alcohol	shrubbery	book
shrubbery	bottle	plant	history
plant	alcohol	flowers	past events
flowers	excess	shrubbery	history
shrubbery	alcohol	plants	past events
flowers	drink	animals	history
shrubbery	excess	plants	government
life	alcohol	animal	politics
death	medicine	Hitler	Germany
	life	death	Munich

13.	14.	15.
color	picture	letter
white	television	post office
black	picture	job
white	painting	post office
black	picture	job
white	painting	civil service
black	picture	government
white	painting	Hitler
black	Mona Lisa	Mussolini
white	Louvre Museum	Italina
black	Paris	Rome

APPENDIX B

FORMULA USED IN CALCULATING THE "t-test"

Source: Edwards (1963)

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s_{\bar{x}_1 - \bar{x}_2}}$$

where $$s_{\bar{x}_1 - \bar{x}_2} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

and $$s^2 = \frac{\sum (X - \bar{X})^2}{n-1}$$

df = 2n-2 when F is insignificant

and df = $\frac{2n-2}{2}$ when F is significant

APPENDIX C

FORMULA USED IN CALCULATING THE "F-ratio"

Source: Edwards (1963)

$$F = \frac{s_1^2}{s_2^2}$$

$$df = n-1 \ \& \ n-1$$

STIMULUS CARDS USED IN THE SERIAL WORD ASSOCIATION TEST

horse

green

car

sparrow

table

hand

hat

butterfly

hammer

spoon

APPENDIX E

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF ANALYTIC SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

Stimulus Word	Analytic Serial Associations
horse	shoe, tail, hair, bright eyes, hoofs, hide, meat, shit, head, power
car	rings, engine, wheels, license, rubber tires, body, framework, radiator, horse-power, tires, motor, top, lights, power, chrome
table	nail, frame, table legs, table top, table wheels, table boards, four legs, top, steel, legs, sides, top border, walnut, table leaf, brackets (legs)
hat	hat band, felt, flowers, rubber, angora
hammer	head, hammer handle, handle, claws, hammer head, steel, wood, iron, metal
green	
sparrow	blood, feathers, wings, legs, bill, tail
hand	ring finger, fingers, finger nails, five fingers, index finger, palm, thumb, left index finger, right index finger, nail, bones, flesh, blood, tissue, joints
butterfly	huge wings, wings, feeler, antenna, stomach, winged
spoon	metals, steel, nickel plated, wood, silver, handle

APPENDIX F

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF DESCRIPTIVE SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

Stimulus Word	Descriptive Serial Associations
horse	young stock, breed, crafty, pony, work horses, horsepower, companion, wild, intelligent, Pferd horse, beautiful, dark, mare, nag, Palamino
car	cab, hot rod, 1969 model, Ford, Volks-wagen, clean, marks (dents), sedan, white walls, 2-tone, 4-passenger, Pontiac, Ford, Chev., Mercury
table	rotten, snooker, billiards, card table, lamp table, round, black, brown, table for five, red top, wooden, work, large, head table, long table
hat	dignified, warm, derby, lid, top, working, cowboy hat, dirty, smart, cap, impressive, chic, interesting, red, top hat
hammer	chipping hammer, hard, jack hammers, welding hammer, sledge hammer, wooden, one-headed, electric hammer, steam-driven hammer, hard-headed, sledge, broken, smooth, shiny, ball pean
green	grass, garden, wool, clothing, green grass, green paint, green trees, green cars, green light, green shirts, green lumber, green linoleum, green ties, green fields, plants
sparrow	black, nice birds, pest, dirty, scavenger, nuisance, tiny, lofty, quick, plump, common, ordinary bird, common bird, tree sparrow, field sparrow

....Continued

hand	human, useful, dressing aid, good, rough, soft, hurt, large, steady, warm, tools, prints, coarse, clean, weapon
butterfly	tired, light, large butterfly, small butterfly, colorful, carefree, beautiful, lazy, nice, pretty, yellow, weak, clumsy, Monarch, creature
spoon	teaspoons, sugar spoons, dessert spoons, soup spoons, mixing spoon, butter spoons, silver, gold, baby spoon, fishing hook, full, stainless, dirty spoon, clean spoon, silver spoon

APPENDIX G

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF ACTION SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

Stimulus Word	Action Serial Associations
horse	riding, haying, speed, handling, ride, work, races, falling, rodeo, pleasure riding, trail riding, packing, chuckwagon racing, racing, working
car	handling, speed, ride, drive, drag races, accident, race, steering, driving, racing (cars), rodeos (cars), shine, crash
table	eat, operating, sitting, eating, writing, polish, shine, dinner, meal, play, card game, breakfast, supper, work, set
hat	wear, trick, fitting, dressing(clothes)
hammer	pound nails, pulling nails, work, build, fix, hit, building, construct, shoeing, grip, bang, repair, break, smash
green	
sparrow	eating, chirping, hunting, flying, fly, tree, migration, eat, bath, singing, chirps, hops (jumps), sings, scratch
hand	marking, work, write, touch, drying, helping people, garden work, repair work, testing grain, fighting, fist, eat
butterfly	flying, landing, catching, floating, net them, press them, catching net, flutter, fly, movement, speed, hover, catch, kill
spoon	eating, stir, eat, dig, stirring, shine, cooking, spooning, mix, use, lunch, breakfast, table set, mixing, table setting

APPENDIX H

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF IN-CATEGORY SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

Stimulus Word	In-Category Serial Associations
horse	cattle, animals, cow, dog, cat, pig, sheep, colt, mice, chicken, duck, geese, bull, rooster, lamb
car	transportation, truck, automobile, bus, wagon, trunk, train, airplane, ship, bicycle, motorcycle, scooter, taxi
table	chair, furniture, mantle piece, bench, counter, desk, stove, cupboard, chesterfield, bed, lawn chairs, radio
hat	coat, suit, oxfords, tie, cap, dress, clothes, collar, uniform, gloves, scarf, shirt, helmet, head gear, safety helmet
hammer	carpenter tool, tool, saw, hammer mill, chipping gun, wrench, welding machine, chisel, axes, square, level, crowbar
green	color, brown, yellow, white, blue, red, black, orange, pink, silver, gold, tan, purple, grey, amber
sparrow	bird, hawk, chicken, duck, swan, eagle, wood duck, goose, owl, swallow, house bird, bluebird, gull, wren, woodpecker
hand	arm, feet, bodypart, wrist, shoulder, head, ribs, spine, legs, foot, toes, hips, face, body, elbow
butterfly	insect, flies, bee, larva, caterpillar, moth, worm, ants, bugs, lady bug, mosquito
spoon	knife, fork, silverware, utensil, plate, cup, soup bowl, pot, pan, dish, silver setting, mug, cutlery, laddle, saucer

APPENDIX I

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF PHYSICAL PROXIMITY SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

Stimulus Word	Physical Proximity Serial Associations
horse	meadows, dusty trails, harness, barn, cowboy, saddle, trailer, trails, stables, frontiersman, feed, sugar, coral, buggy
car	gas, road, garages, highways, car gas, driver, school zone, gas, gasoline, tools, signs, red light, yield right of way
table	table cloth, meals, table flowers, food, dishes, dining room, floor, kitchen, mat, doilie, bowl, sideboard (of cupboard)
hat	nose, head, hat rack, light ribbon, man, children, elders, hair, women, hat shops, lady, model
hammer	large nails, lumber, carpentry, nails, carpenter, wood, plywood, boards, wood-work, construction, tool box, building
green	
sparrow	nest, caragana, trees, sparrow nest, sparrow eggs, flocks, hedge, snow, eggs, nature, young, mate, seeds, feed
hand	nails, glove, cast, rings, mitt, pipe, match, food
butterfly	nature, cocoon, flowers, pollen, net, cabbage, garden, grass, tree, dandelions, field, leaves, rosebush, brush
spoon	table, sugar, desserts, porridge, tea, coffee, food, stove, oven, kitchen, china, soup, cereal, pudding, stew

APPENDIX J

EXAMPLES, GIVEN BY EXPERIMENTAL AND CONTROL PATIENTS, OF UNRELATED SERIAL ASSOCIATIONS WITH THEIR PRECEDING STIMULUS WORDS

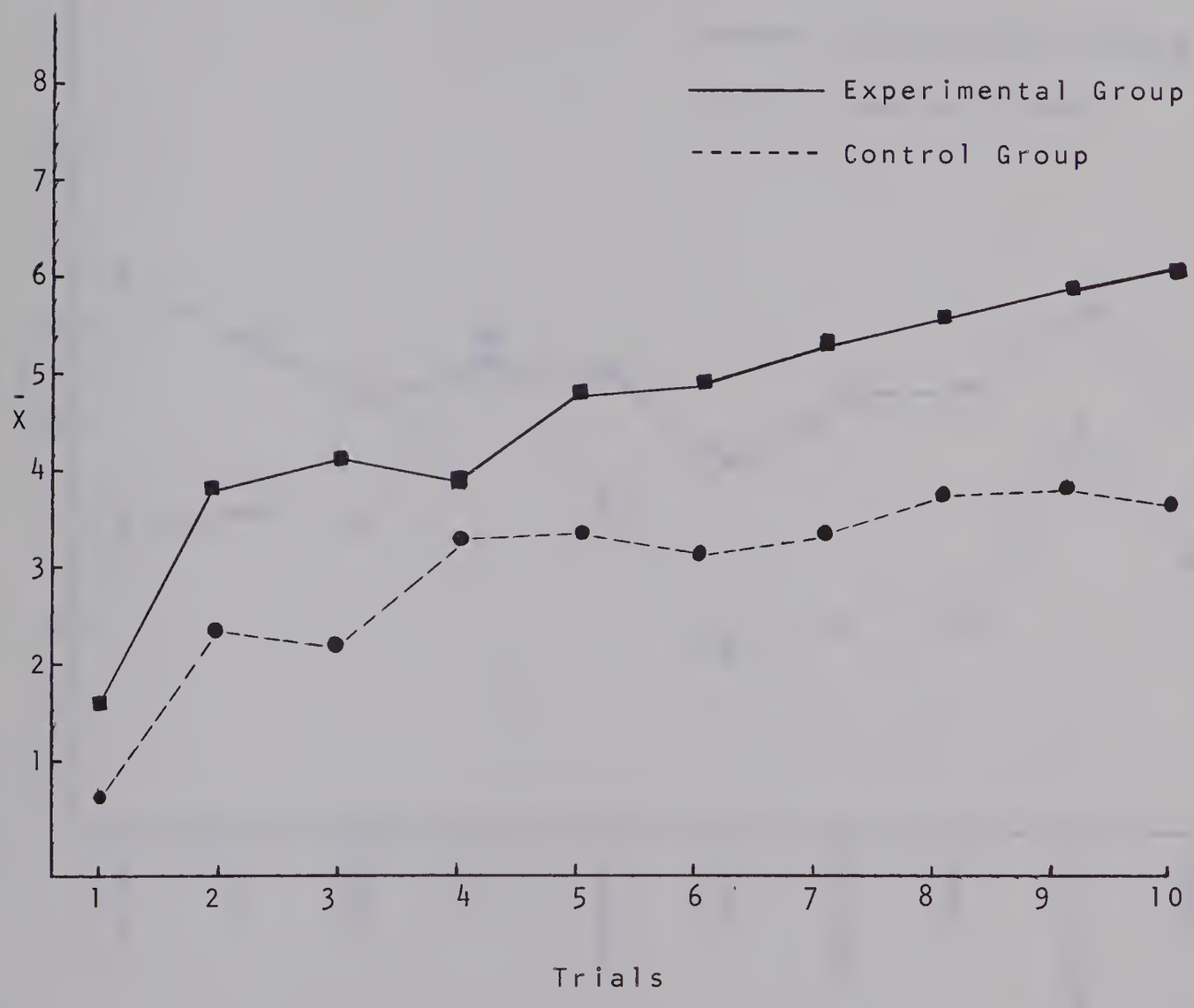
Stimulus Word	Unrelated Serial Associations
horse	finger, John, window, tobacco, blue, road, neighbors, glory, enjoyment, skill, entertainment, fellowship, capabilities, travel
car	ear, nose, desk, hose, feet, bed, pencil, make, comfort, competition, excitement, human capabilities, decisions, daring
table	town, blurred, switch, picture, ask, Labour, train, family, people, enjoyment, household necessity, material used, group entertainment, fellowship, gathering
hat	file, drapes, lead, rice, Adam, coffee, iron, ashtray, color, make, styling, usefulness, well dressed, age, superiority
hammer	axle, lock, door knob, God, sick, doctor, Walker, red, curtain, player, housing, garage, usefulness, training, craftmenship
green	stove, key, snow, frost, healthy, beauty, new, crude oil, girlfriend, cutting hay, song, summer, golf
sparrow	cards, man, coffee, button, numerous, abilities, city, friend, country, number, health, father, their food
hand	eyesight, sleep, office, gutter, telephone, women, girls, shape, music, capabilities, destruction, types, knowledge, development

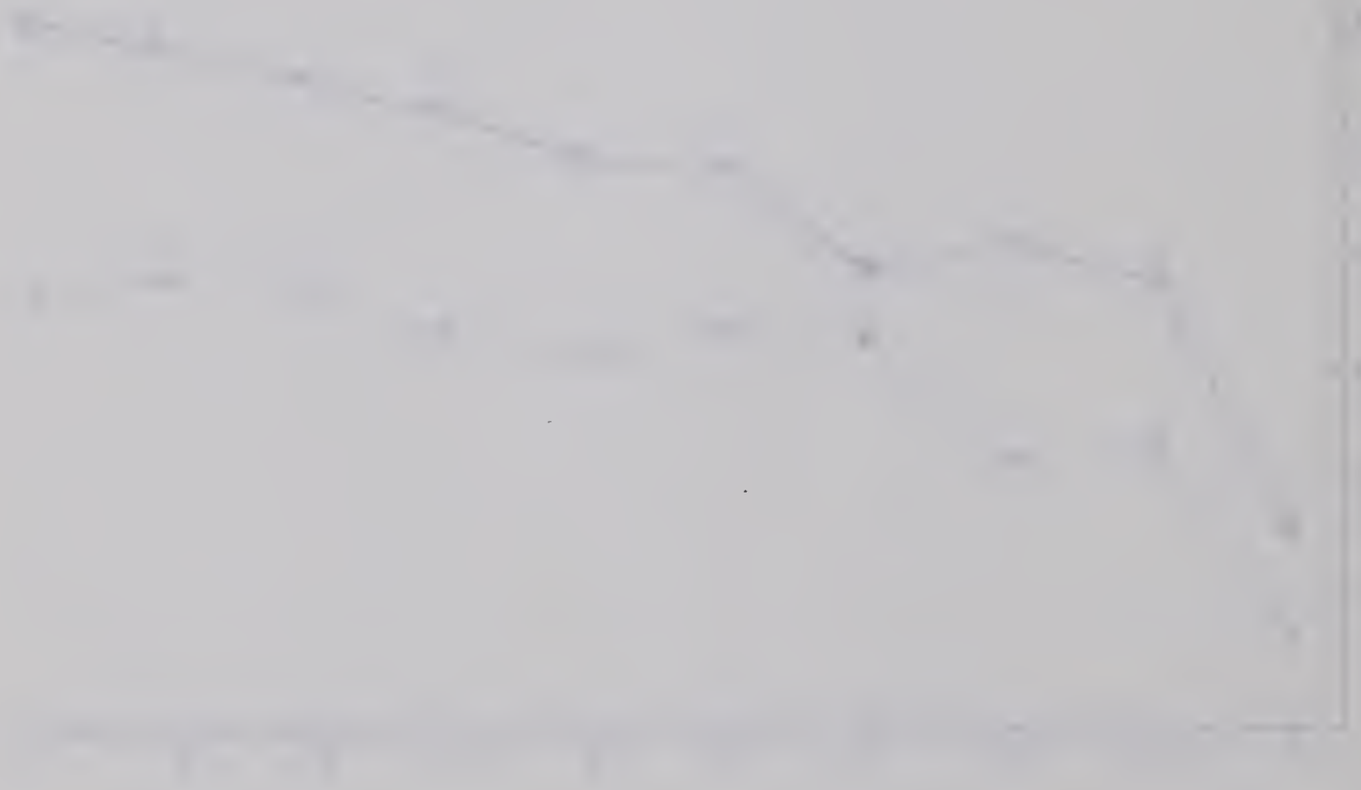
....Continued

butterfly	canary, color, jump, damn, chair, bed, nose, like, school, children, medium sizes, usefulness
spoon	leg, brown, hay, white, modern, hand, usefulness, development, humor, employment, pleasure, idolize, love, wack

APPENDIX K

UNRELATED SERIAL ASSOCIATIONS: MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUP ON EACH TRIAL, OVER ALL STIMULUS WORDS





APPENDIX L

UNRELATED SERIAL ASSOCIATIONS: MEAN SCORES OF EXPERIMENTAL AND CONTROL GROUP ON EACH STIMULUS WORD, OVER ALL TRIALS